CLAIMS

What is claims is:

1. An apparatus for use generating illumination, comprising:

a reflective base;

a first light source positioned proximate the reflective base; and

a reimaging reflector positioned partially about the first light source, where a percentage of light emitted from the first light source is reflected from the reimaging reflector to the reflective base adjacent the first light source establishing a first real image of the first light source adjacent the first light source such that the reflective base reflects the light of the first real image.

2. The apparatus of claim 1, wherein the reimaging reflector is generally a quarter ellipsoid with a first focus positioned on the first light source and a second focus positioned proximate the first light source at a position of the first real image.

3. The apparatus of claim 2, wherein the second focus is further positioned below the reflective base at a height below a surface of the reflective base equal to a height of a light emitting surface of the first light source from the surface.

4. The apparatus of claim 1, wherein the reimaging reflector comprises a first sector of a first prolate ellipsoid and a second sector of a second prolate ellipsoid, where the first and second sectors joined along an axis.

5. The apparatus of claim 4, wherein a first percentage of the light reflected from the reimaging reflector is reflected from the first sector to the reflective base adjacent the first light source at the first real image of the first light source adjacent the first light source on a first side of the first light source such that the reflective base reflects the light of the first real image; and

a second percentage of the light reflected from the reimaging reflector is reflected from the second sector to the reflective base adjacent the first light source establishing a second real

image of the first light source adjacent the first light source such that the reflective base reflects the light of the second real image.

6. The apparatus of claim 5, wherein the first sector of the reimaging reflector is defined by a first ellipsoid having first and second foci, and the second sector of the reimaging reflector is defined by a second ellipsoid having third and fourth foci;

the first sector is positioned relative to the first light source such that the first focus is positioned on the first light source and the second focus is positioned to the first side of the first light source proximate the first light source at a position of the first real image; and

the second sector is positioned such that the third focus is positioned on the first light source and the fourth focus positioned to the second side of the first light source proximate the first light source at a position of the second real image.

7. The apparatus of claim 1, wherein the reimaging reflector comprises four sectors distributed along an axis with each of the four sectors defined by four prolate ellipsoids, where a first percentage of light reflected from the reimaging reflector is reflected by a first sector of the reimaging reflector to the reflective base at a first side the first light source establishing the first real image of the first light source, and where a second percentage of light reflected from the reimaging reflector is reflected by a second sector of the reimaging reflector to the reflective base adjacent the first light source on a second side of the first light source establishing a second real image of the first light source adjacent the first light source such that the reflective base reflects the light of the second real image.

8. The apparatus of claim 1, further comprising:

a tailored free-form exit face positioned at least partially about the light source such that the percentage of light reflected by the reimaging reflector and light emitted from the source not reflected by the reimaging reflector is emitted from the exit face establishing an output illumination that meets a predefined prescription.

9. The apparatus of claim 1, further comprising:

a lens wherein the first light source is positioned proximate the lens such that the lens receives the light from the first light source and the first real image.

10. The apparatus of claim 9, wherein the lens comprises the reimaging reflector, and a cavity in which the first light source is positioned.

11. The apparatus of claim 10, wherein the lens further comprises:

first reflective surface positioned to receive the light from the first light source and the first real image;

a reflector array positioned to receive light reflected from the first reflective surface;

a mirrored surface positioned to receive reflected light from the reflector array; and

an output surface.

12. The apparatus of claim 1, further comprising:

a lens comprising:

the reimaging reflector;

input surface defining a cavity that receives the first light source;

reflective fingers;

reflective folding face; and

exit face.

13. The apparatus of claim 1, further comprising:

a totally internally reflecting (TIR) lens positioned proximate the first light source opposite from the reimaging reflector such that the TIR lens receives light reflected by the first real image.

14. The apparatus of claim 13, wherein the TIR lens is a decentered lens comprising exit face, a central refractive lens, grooved facets having entry faces, and totally internally reflecting faces positioned relative to the grooved entry faces to receive light entering the lens from the entry faces of the grooved facets and to reflect the received light to the exit face.

15. The apparatus of claim 14, wherein the TIR lens comprises a decentered generally rectangular TIR lens having dimensions of a rectangular section of length defined according to a defining complete circular TIR lens extend from a center to a peripheral edge of the defining complete circular TIR lens.

16. The apparatus of claim 1, wherein the first real image is positioned adjacent the light source but separated from the light source by a gap.

17. Apparatus for use in transmitting light, comprising:

a first etendue squeeze light source comprising a first reimaging reflector positioned partially about the first light source, where a percentage of light emitted from the first light source is reflected from the first reimaging reflector establishing a first real image of the first light source adjacent the first light source.

18. The apparatus of claim 17, further comprising:

a second etendue squeeze light source comprising a second reimaging reflector positioned partially about the second light source, where a percentage of light emitted from the second light source is reflected from the second reimaging reflector establishing a first real image of the second light source adjacent the second light source.

19. The apparatus of claim 18, further comprising:

a luminaire comprising first and second reflective surfaces, where the first source is positioned proximate an edge of the second reflective surface to direct light onto the first reflective surface, and the second source is positioned proximate an edge of the first reflective surface to direct light onto the second reflective surface.

20. The apparatus of claim 19, wherein the first and second source each further comprises a free-form lens positioned to receive light from the respective light source and the respective first and second real images, such that the light passes through the free-form lens at solid angle subtended by dimensions of the corresponding first and second reflector surfaces.

21. The apparatus of claim 19, wherein the luminaire is a generally boat-shaped luminaire, where in the first and second reflective surfaces are generally paraboloidal, and the first source is positioned at a focal point of the paraboloidal first surface and the second source is positioned at a focal point of the paraboloidal second surface.

22. The apparatus of claim 18, further comprising:

at least one additional etendue squeeze light source where there are an odd total number of light sources; and

a luminaire comprising an odd number of reflective surfaces, where each reflective surface is positioned proximate two other reflective surfaces of the odd number of reflective surfaces defining two intersections where one of the odd number of reflective surfaces is positioned opposite each intersection; and

wherein each of the odd number of light sources is positioned at each of the intersections to direct light onto the oppositely positioned reflective surface.

23. The apparatus of claim 18, further comprising:

additional plurality of etendue squeeze light sources where there are an even total number of light sources; and

a luminaire comprising an even number of reflective surfaces, each reflective surface is positioned opposite another one of the reflective surfaces; and

wherein each of the even number of light sources is positioned proximate at an edge of and near a center of one of the even number of reflective surfaces such that light emitted from each of the light sources is directed to a reflective surface opposite the reflector to which each source is proximally positioned.

24. The apparatus of claim 18, further comprising:

a luminaire comprising a plurality of TIR lens portions that are positioned opposite one other TIR lens portion;

wherein the first source is positioned proximate an outer edge of a second TIR lens portion and directs light to a first TIR lens portion positioned opposite the second TIR lens

portion, and the second source is positioned proximate an outer edge of the first TIR lens portion and directs light to the second TIR lens portion.

25. The apparatus of claim 24, wherein the first and second light sources include confocal lenses through which the light is directed to the corresponding first and second TIR lens portions, respectively, and the reimaging reflectors of each of the first and second light sources are positioned away from the corresponding first and second TIR lens portions, respectively.

26. The apparatus of claim 24, wherein the first and second light sources are positioned on an opposite side of a plane from the TIR lens portions, where the plane is defined by the edges of each of the TIR lens portions.

27. The apparatus of claim 24, wherein the first and second sources are further positioned a distance radially away from the proximate second and first TIR lens portions, respectively, and towards the corresponding first and second TIR lens portions at which the first and second light source direct light.

28. A lens comprising:

a reimaging reflector positioned to receive a percentage of a total light received by the lens, the reimaging reflector reflects the percentage of light establishing a first real image that is further directed away from the reimaging reflector and into the lens.

29. The lens of claim 28, wherein the reimaging reflector is generally ellipsoidal in shape.

30. The lens of claim 29, wherein the reimaging reflector comprises a plurality of sectors where each sector is defined by a prolate ellipsoid, such that a first sector reflects a first sub-percentage of the percentage of light establishing the first real image, and a second sector reflects a second sub-percentage of the percentage of light establishing a second real image that is further directed away from the reimaging reflector and into the lens.

31. The lens of claim 28, further comprising:

first etendue-squeezing reflector and second etendue-squeezing reflector both positioned to receive a percentage of the total light received.

32. The lens of claim 31, wherein the first etendue-squeezing reflector has a profile comprises a parabola segment and an ellipse segment, where the parabola segment and the ellipse segment both have a common axis of revolution and meeting with the same tangent.

33. The lens of claim 28, further comprising:

central refractive semi-lens;

reflective first surface;

a generally semicircular emitting second surface; and

semi-hemispheric cavity that receives a light source.

34. A method of manufacturing an optical device, comprising:

defining a first position for placement of an optical source; and

defining a first prolate paraboloidal surface comprising:

defining a first focus at the first position; and

defining a second focus at a second position a first distance from the first position in a first direction, providing a three-dimensional representation of an optical source.

35. The method of claim 34, wherein the defining the second focus further comprises:

defining a plane relative to the optical source and the first position such that a second distance is defined in a second direction from the plane to an emitting surface of the optical source; and

defining the second focus of the first paraboloidal surface at a third distance defined in a third direction from the plane to the second focus where the third distance is equal to the second distance such that the third direction is opposite the second direction.

36. The method of claim 31, further comprising:

defining a second prolate paraboloidal surface comprising:

defining a first focus of the second paraboloidal surface at the first position; and

defining a second focus of the second paraboloidal surface at a third position a fourth distance from the first position in a direction opposite the first direction.

37. The method of claim 36, further comprising:

defining third and fourth paraboloidal surfaces comprising:

defining a plane relative to the optical source and the first position such that a second distance is defined in a second direction from the plane to an emitting surface of the optical source;

defining a first focus at the first position; and

defining a second focus of both the third and fourth paraboloidal surface at a fifth distance from the plane in the second direction that is at least equal to the second distance.

38. The method of claim 34, further comprising:

generating a representation of an optical lens, comprising:

generating a two-dimensional representation of a plurality of entry surfaces and a plurality of corresponding reflective surfaces, and exit surface;

rotationally sweeping the two-dimensional representation about a central axis providing a three-dimensional representation of the plurality of entry and corresponding reflective surfaces, and exit surface; and

defining a cutout of the three-dimensional representation that extends from a center of the three-dimensional representation at the central axis to a periphery of the three-dimensional representation providing a three-dimensional representation of the optical lens; and

defining positioning of the representation of the optical source relative to the optical lens such that the optical source is closer to the central axis than the periphery of the optical lens.

39. A method of manufacturing an optical device, comprising:

generating a two-dimensional representation of a plurality of entry surfaces and a plurality of corresponding reflective surfaces, and exit surface;

rotationally sweeping the two-dimensional representation about a central axis providing a three-dimensional representation of the plurality of entry and corresponding reflective surfaces, and exit surface; and

defining a cutout of the three-dimensional representation that extends from about a center of the three-dimensional representation at the central axis to a periphery of the three-dimensional representation providing a three-dimensional representation of an optical lens.

40. The method of claim 39, further comprising:

defining an optical source for positioning proximate the central axis, comprising:

defining a first position for placement of an optical source; and

defining a first prolate paraboloidal surface comprising:

defining a first focus at the first position; and

defining a second focus at a second position a first distance from the first position in a first direction.

41. The method of claim 40, wherein the defining the optical source further comprises:

defining a second prolate paraboloidal surface comprising:

defining a first focus of the second prolate paraboloidal surface at the first position; and

defining a second focus of the second prolate paraboloidal surface at a third position a first distance from the first position in a second direction opposite the first direction.

42. The method of claim 40, wherein the defining the cutout further comprises defining the cutout such that the three-dimensional representation is a generally circular representation representing a decentered circular totally internally reflecting lens.

43. The method of claim 42, wherein the generating the two-dimensional representation of the plurality of corresponding reflective surfaces comprises defining a plurality of totally internally reflecting faces that redirect light towards the exit surface.

44. The method of claim 40, wherein the defining the cutout further comprises defining the cutout such that the three-dimensional representation is a generally rectangular configuration with a length that extend center axis to the periphery of the three-dimensional representation, and wherein the generating the two-dimensional representation further comprises defining a central refractive lens, the generating the two-dimensional representation of the plurality of entry faces and reflective surfaces comprises defining a plurality of grooved facets each with an entry face and a totally internally reflecting reflective surface.